

## **CLAIMS**

I claim:

1. A mounting device for mounting an element on a shaft, comprising:  
an outer sleeve having an internal bore having a tapered portion and a frustoconical external surface, wherein the outer sleeve is substantially solid to prevent expansion or contraction when the device is tightened or loosened;  
an inner sleeve comprising:  
an internal bore;  
a threaded portion;  
an external tapered portion configured to cooperate with the tapered portion of the outer sleeve;  
an axially elongated slot extending along the sleeve to allow expansion and contraction of the inner sleeve;  
a locking ring threadedly engaging the threaded portion of the inner sleeve;  
wherein turning the locking ring in a first direction operates to displace the inner sleeve in a first direction relative to the outer sleeve so that the external tapered portion of the inner sleeve rides up the internal tapered surface of the outer sleeve, causing the internal bore of the inner sleeve to contract, thereby tightening the device.
2. The mounting device of claim 1 wherein turning the locking ring in a second direction opposite the first direction operates to displace the inner sleeve in a second direction relative to the outer sleeve so that the external tapered portion of the inner sleeve rides down the internal tapered portion of the outer sleeve allowing the internal bore of the inner sleeve to expand, thereby loosening the device.

3. The mounting device of claim 1 wherein at least one of the inner sleeve and the outer sleeve is formed of plastic.
4. The mounting device of claim 1 wherein the frustoconical engagement surface of the outer sleeve is formed of a plastic having a coefficient of friction of at least 1.0.
5. The mounting device of claim 1 wherein the frustoconical engagement surface of the outer sleeve is formed of a plastic having a coefficient of friction of less than 1.0.
6. The mounting device of claim 1 wherein the inner sleeve comprises a plurality of axial slots extending through the inner sleeve along the tapered portion.
7. The mounting device of claim 1 wherein the forward end of the outer sleeve has a reduced diameter opening having a diameter that is smaller than the outer diameter of the forward end of the inner sleeve.
8. The mounting device of claim 1 comprising a connector connecting the outer sleeve and the locking ring to impede relative axial displacement between the outer sleeve and the locking ring, while allowing relative circumferential displacement between the locking ring and the outer sleeve.
9. A mounting device, comprising:  
an outer sleeve having a generally frustoconical external engagement surface and an internal bore having a diameter;  
a radially deformable inner sleeve comprising an internal bore and configured to cooperate with the bore of the outer sleeve to affect

contraction of the inner sleeve bore;  
one of the outer sleeve and inner sleeve having a threaded portion;  
the other of the outer sleeve and the inner sleeve having a first connector;  
a locking ring comprising: a threaded portion configured to threadedly engage the threaded portion of the one sleeve, and a second connector configured to cooperate with the first connector to connect the locking ring with the other sleeve to prevent substantial relative axial displacement between the locking ring and the other sleeve;  
wherein the outer sleeve is configured to impede expansion of the engagement surface when the device is tightened by turning the locking ring in a first direction, which causes displacement of the inner sleeve relative to the outer sleeve.

10. The mounting device of claim 9 wherein the outer sleeve walls are substantially solid along the length of the engagement surface.
11. The mounting device of claim 9 wherein the outer sleeve bore comprises a portion having walls tapered and the external surface of the inner sleeve comprises a tapered portion configured to cooperate with the tapered bore of the outer sleeve.
12. The mounting device of claim 9 wherein the engagement surface of the outer sleeve is substantially rigid.
13. The mounting device of claim 9 wherein the inner sleeve comprises an axial slot.
14. The mounting device of claim 9 wherein the engagement surface is formed of a plastic material.

15. A method for mounting an elongated element having a generally cylindrical bore onto a shaft, comprising the steps of:  
providing a first mounting device having an external sleeve with a tapered engagement surface, an inner sleeve and a locking ring;  
providing a second mounting device having an external sleeve with a tapered engagement surface, an inner sleeve and a locking ring;  
placing the elongated element onto the shaft so that the shaft extends through the bore of the elongated element;  
positioning the first mounting on the shaft so that the tapered engagement surface engages the internal bore of the elongated element;  
positioning the second mounting device on the shaft so that the tapered engagement surface engages the internal bore of the elongated element;  
turning the locking ring of the first mounting device to contract the inner sleeve to thereby connect the inner sleeve to the shaft without expanding the outer sleeve of the first mounting device; and  
turning the locking ring of the second mounting device to contract the inner sleeve to thereby connect the inner sleeve to the shaft without expanding the outer sleeve of the second mounting device.
16. The method of claim 15 comprising the step of spacing the second mounting device apart from the first mounting device a sufficient distance to allow the elongated element to rotate relative to the first and second mounting devices.
17. The method of claim 15 comprising the step of rotating the elongated element relative to the shaft while the first and second mounting devices are tightened to the shaft.
18. The method of claim 15 comprising the step of forcing the second

mounting device against an end of the elongated element after the step of turning the locking ring of the first mounting device, to thereby wedge the elongated element between the first and second mounting devices to provide a frictional connection between the elongated element and the first and second mounting devices to impede rotation of the elongated element relative to the shaft.

19. The method of claim 15 wherein the bore of the outer sleeve of each of the first and second mounting devices comprises a minor diameter and the inner sleeve of each of the first and second mounting devices comprises a tapered surface having a major diameter that is larger than the minor diameter of the corresponding outer sleeve, wherein the steps of turning the first and second locking rings operates to displace the major diameter of each inner sleeve relative to the corresponding outer sleeve, toward the minor diameter of the corresponding outer sleeve thereby wedging the inner sleeves radially inwardly.
20. The method of claim 15 wherein the locking ring of the first mounting device threadedly engages one of the inner and outer sleeves of the first mounting device and is connected with the other of the inner and outer sleeve of the first mounting device.
21. A method for mounting an elongated element having a generally cylindrical bore onto a shaft, comprising the steps of:  
providing a first mounting device having an outer sleeve with a tapered internal surface, an inner sleeve having a tapered external surface and a locking ring;  
providing a second mounting device having an outer sleeve with a tapered internal surface, an inner sleeve having a tapered external surface and a locking ring;

placing the elongated element onto the shaft so that the shaft extends through the bore of the elongated element;  
positioning the first mounting on the shaft so that the outer sleeve engages a first end face of the elongated element;  
positioning the second mounting device on the shaft so that the outer sleeve engages a second end face of the elongated element;  
turning the locking ring of the first mounting device to contract the inner sleeve to thereby connect the inner sleeve to the shaft without expanding the outer sleeve of the first mounting device; and  
turning the locking ring of the second mounting device to contract the inner sleeve to thereby connect the inner sleeve to the shaft without expanding the outer sleeve of the second mounting device.

22. The method of claim 21 comprising the step of spacing the second mounting device apart from the first mounting device a sufficient distance to allow the elongated element to rotate relative to the first and second mounting devices.
23. The method of claim 21 comprising the step of rotating the elongated element relative to the shaft after the first and second mounting devices are tightened to the shaft.
24. The method of claim 21 wherein the bore of the outer sleeve of each of the first and second mounting devices comprises a minor diameter and the inner sleeve of each of the first and second mounting devices comprises a tapered surface having a major diameter that is larger than the minor diameter of the corresponding outer sleeve, wherein the steps of turning the first and second locking rings operates to displace the major diameter of each inner sleeve relative to the corresponding outer sleeve, toward the minor diameter of the corresponding outer sleeve thereby

wedging the inner sleeves radially inwardly.

25. The method of claim 21 wherein the locking ring of the first mounting device threadedly engages one of the inner and outer sleeves of the first mounting device and is connected with the other of the inner and outer sleeve of the first mounting device.
26. A mounting device for mounting an element having an internal bore onto a shaft, comprising:
  - an outer sleeve having an outer diameter greater than the internal bore of the element, and an internal bore having a tapered surface;
  - a radially deformable inner sleeve comprising an internal bore and configured to cooperate with the bore of the outer sleeve to affect contraction of the inner sleeve bore;
  - one of the outer sleeve and inner sleeve having a threaded portion;
  - the other of the outer sleeve and the inner sleeve having a first connector;
  - a locking ring comprising: a threaded portion configured to threadedly engage the threaded portion of the one sleeve, and a second connector configured to cooperate with the first connector to connect the locking ring with the other sleeve to prevent substantial relative axial displacement between the locking ring and the other sleeve;
  - wherein the outer sleeve is substantially rigid to impede expansion of the outer sleeve when the device is tightened by turning the locking ring in a first direction, which causes displacement of the inner sleeve relative to the outer sleeve.
27. The mounting device of claim 26 wherein the outer sleeve bore comprises a portion having walls tapered and the external surface of the inner sleeve comprises a tapered portion configured to cooperate with the tapered bore

of the outer sleeve.

28. The mounting device of claim 26 wherein the inner sleeve comprises an axial slot.
29. The mounting device of claim 9 wherein the outer sleeve is formed of a plastic material.